C. 7274

FEBRUARY 1944

1 6 1944
U. LIBRARY

UNITED STATES
DEPARTMENT OF THE INTERIOR
HAROLD L. ICKES, SECRETARY

BUREAU OF MINES
R. R. SAYERS, DIRECTOR

INFORMATION CIRCULAR

COAL-MINE EXPLOSIONS AND COAL- AND METAL-MINE FIRES IN THE UNITED STATES DURING THE FISCAL YEAR ENDED JUNE 30, 1943

BY

D. HARRINGTON AND W. J. FENE

Generated on 2024-09-19 13:48 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

Original from
THE OHIO STATE UNIVERSITY

I.C. 7274,
February 1944.

INFORMATION CIRCULAR

UNITED STATES DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

COAL-MINE EXPLOSIONS AND COAL- AND METAL-MINE FIRES IN THE UNITED STATES DURING THE FISCAL YEAR ENDED JUNE 30, 1943[1]

By D. Harrington[2] and W. J. Fene[3]

INTRODUCTION

Insofar as prevention of mine explosions is concerned, it is apparent that the coal-mining industry has profited but little from experiences during the past 15 years. The fact that explosions can be prevented if well-known preventive measures are adopted and conscientiously carried out appears to warrant the conclusion that many coal-mining people are indifferent to the hazards that may result in explosions. Although the principal burden of preventing explosions is upon the management, and much of the evident carelessness in failing to place in effect and to enforce suitable precautions, is assessable directly against management, the worker also has a very definite responsibility, and numerous explosions have resulted because of his failure to carry out his part in accepted principles of safety.

The record of fatalities from mine explosions during the past 5 fiscal years has been anything but encouraging or about which coal-mining people can take pride; more men were killed by explosions (673) than were killed from the same cause during the preceding eight years combined (577). During each of the fiscal years 1942 and 1943, 152 fatalities resulted from explosions, compared to 163 during the fiscal year 1941, 206 in 1940, and only 16 in 1939.

---

[1] The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is made: "Reprinted from Bureau of Mines Information Circular 7274."

[2] Chief, Health and Safety Service, Bureau of Mines, Washington, D. C.

[3] Chief, Coal Section, Mineral Production Security Division, Bureau of Mines, Washington, D. C.

Generated on 2024-09-19 13:43 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

SUMMARY OF MINE EXPLOSIONS, BY STATES AND CAUSES

Table 1 summarizes essential data on 32 explosions known to have occurred in 13 States and to have resulted in 152 deaths during the fiscal year ended June 30, 1943. It contains information on all coal-mine explosions in the United States during the fiscal year that were brought to the attention of the Bureau of Mines and is believed to cover every explosion in which life was lost or considerable damage was caused. The 32 explosions occurring during the past fiscal year were 10 more than the number known to have occurred during the previous year; the number of deaths (152) was the same as during the previous year.

The greatest number of deaths from explosions in any State during the past fiscal year occurred in Montana (74); West Virginia had 22 deaths; Alabama, 12; Kentucky and Tennessee, 10 each; Ohio and Oklahoma, 7 each; Arkansas, 5; Colorado, 3; and Illinois and Pennsylvania, 1 each. An explosion occurring in Indiana and one in Virginia did not result in death.

The five major explosions during the fiscal year resulted in 122 deaths; during 1942 there were 7 major explosions with resultant 135 deaths; and during 1941 there were 8 major explosions with 144 deaths. (A major explosion is one in which five or more fatalities occur.) Eight of the thirty-two explosions known to have occurred during the past year did not result in fatalities. The anthracite mines of Pennsylvania (many of which are extremely gassy), employing approximately 100,000 men and yielding an average of 50 million tons of coal per year, have had a very good record of operating more than 5 years without a major explosion up to the end of the fiscal year ended June 30, 1943. Also, Pennsylvania's bituminous mines had only one fatality from explosions during the past fiscal year, giving the State of Pennsylvania, with over 200,000 coal-mining employees, an admirable record as to explosions.

Generated on 2024-09-19 13:43 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 13:48 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

TABLE 1. - Summary of coal-mine explosions, by States and causes, fiscal year ended June 30, 1943

State	Lighting used			Fatalities, by ignition causes									
				Electricity		Open lights or smoking		Explosives		Miscellaneous		Total	
	Open	Closed	Unknown	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions
Alabama	1	1	1	12	2	-	1					12	3
Arkansas	4	-	-	3	2	2	2	-	-	-	-	5	4
Colorado	-	-	1	3	1	-	-	-	-	-	-	3	1
Illinois	1	1	-	1	1	0	1	-	-	-	-	11	2
Indiana	1	-	-	-	-	-	-	0	1			0	1
Kentucky	1	3	-	10	4			-	-			10	4
Montana	1	-	-	-	-	74	1	-	-	-	-	74	1
Ohio	1	2	-	4	2	3	1	-	-	-	-	7	3
Oklahoma	1	2	-	-	-	7	2	0	1	-	-	7	3
Pennsylvania	-	2	2	1	1	0	1	0	1	0	1	1	4
Tennessee	-	1	-	10	1	-	-	-	-	-	-	10	1
Virginia	-	1	-	00	1	-	-	-	-	-	-	0	1
West Virginia	-	4	-	22	4	-	-	-	-	-	-	22	4
Total	11	17	4	66	19	86	9	0	3	0	1	152	32

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Table 2 summarizes the causes of explosions that occurred during the fiscal years 1929 to 1943, as determined from records of the Bureau of Mines. It is shown that 66 persons were killed during the past fiscal year in explosions initiated by electricity, compared with 133 in the previous year and an average of 68.8 per year for the preceding 14 years. Deaths from explosions due to electricity decreased about 50 percent compared with the previous year, and were about 4 percent less than the average for the previous 14 years. There were 19 explosions of electrical origin during the fiscal year 1943, compared with 14 during the previous fiscal year and an average of 10.9 during the previous 14 fiscal years. During the past year Kentucky had 4 explosions caused by electricity with 10 deaths; West Virginia had 4, with 22 deaths; Tennessee 1, with 10 deaths; Colorado 1, with 3 deaths; Illinois 1, with 1 death; Pennsylvania 1, with 1 death; and Virginia 1, with no deaths.

During the fiscal year 1943, 9 mine explosions were caused by open lights or smoking compared with 2 during the previous year and an average of 8.7 during the previous 14 years. Eighty-six deaths resulted from explosions caused by open lights and smoking during 1943, compared with 3 deaths from this cause in 1942 and an average 21.9 during the previous 14 years. Alabama, Illinois, and Pennsylvania had 1 explosion each, with no deaths, caused by open lights or smoking; Arkansas had 2, with 2 death Montana had 1 explosion, with 74 deaths; Ohio 1, with 3 deaths; and Oklahoma 2, with 7 deaths. In 8 of these explosions, gas was ignited by carbide lamps, and in one instance gas was ignited by a flame safety lamp held in front of a compressed-air nozzle. One explosion in Montana caus by ignition of explosive gas by a carbide lamp resulted in the death of 74 men.

Three explosions, resulting in no deaths, were caused by explosive during the past fiscal year, compared with 2 explosions with 2 deaths during the previous fiscal year and an average of 3.7 explosions and 22.6 deaths during the previous 14 years. The fact that no explosions causing fatalities are known to have been initiated by explosives during a full fiscal year is remarkable, inasmuch as coal-mine disasters were initiated largely by explosives for many years.

One explosion was reported during the year in which the cause was listed as unknown.

Generated on 2024-09-19 13:44 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 13:50 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

TABLE 2.

Summary of data on explosions, by causes, fiscal years 1929-43, inclusive

Year	Lighting used			Fatalities, by ignition causes									
				Electricity		Open lights or smoking		Explosives		Miscellaneous or unknown		Total	
	Open	Closed	Unknown	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions
1929	18	19	1	93	18	14	11	26	8	6	1	139	38
1930	8	25	1	154	18	21	8	24	6	-	2	199	34
1931	12	14	-	143	9	56	11	18	6	-	-	217	26
1932	15	14	4	11	10	33	15	42	5	1	3	87	33
1933	7	14	1	25	8	63	8	29	4	5	2	122	22
1934	9	14	3	21	10	2	9	2	3	3	4	28	26
1935	6	17	-	29	10	6	8	3	2	16	2	54	22
1936	15	9	1	20	5	10	17	4	1	4	2	38	25
1937	4	12	4	53	12	3	5	-	1	6	2	62	20
1938	10	16	3	24	10	77	11	61	6	8	2	170	29
1939	2	12	-	13	9	2	3	-	-	1	2	16	14
1940	6	11	1	99	6	2	5	103	5	2	2	206	18
1941	5	20	-	145	14	15	9	3	3	-	-	163	26
1942	5	17	-	133	14	3	2	2	2	14	4	152	22
1943	11	17	4	66	19	86	9	0	3	0	1	152	32
Total	133	231	23	1029	172	393	131	317	55	66	29	1805	387

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

RECORD OF EXPLOSIONS, BY STATES

Table 3 shows the record of explosions, by States, for the past 15 fiscal years. During this 15-year period, 387 explosions caused 1,805 deaths, an average of 25.8 explosions and 120.33 deaths per year, also an average of 4.66 fatalities per explosion. The number of explosions (32) occurring during the past fiscal year and the resulting number of deaths (152) were considerably higher than the average for the preceding 14 years. For the 15-year period, Pennsylvania had the greatest total number of explosions, 102, with 302 deaths. West Virginia had 68 explosions with 353 deaths; Ohio, with only 16 explosions, had 209 deaths. Montana experienced its first recorded coal-mine explosion with resultant 74 deaths. It is encouraging to note that during the 15-year period, Kansas and Maryland are reported to have had only one explosion each, 2 fatalities occurring in Kansas and 1 in Maryland. New mexico has not had a reported explosion during the past 10 years, Utah in 13 years, and Wyoming has had only 2 known explosions with a total of 8 deaths during the 15-year period.

The average number of deaths per explosion during the past 15 yea has been 4.66, with a range for the States of 1.00 in Maryland to 74.00 in Montana. States with the highest averages are Montana, 74.00; Alaska, 14.00 (1 explosion each); Ohio, 13.06; Virginia, 8.07; and Oklahoma, 7.10 The following coal-producing States are not listed in table 3, as they are not known to have had an explosion during the past 15 years; Iowa, Michigan, Missouri, North Dakota, and Texas.

CAUSES OF EXPLOSIVES

Table 4 gives data on causes of explosions in the United States du the past 15 years as reported to the Bureau of Mines. In all, 387 explosions were studied during the 15-year period, an average of 25.8 explosions per year. There were 32 explosions during the past fiscal year, 10 more than during the previous year and about 7 more than the averag of the preceding 14 years.

Table 4 shows that electricity was responsible for 172 (44.4 perc and open lights or smoking for 131 (33.) percent) of the explosions liste during the 15 years; hence, 78.3 percent of all known explosions during this 15-year period were started by ignitions due to electricity, open lights, and smoking; this indicates the importance of taking far greater precautions against these hazards than have yet been taken.

Generated on 2024-09-19 13:57 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

TABLE 3. - Record of explosions, by States, during fiscal years 1929-43, inclusive

	1929		1930		1931		1932		1933		1934		1935		1936		1937		1938		1939		1940		1941		1942		1943		Total 15 Years		Average per year		Average deaths per ignition
	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	Deaths	Ignitions	
Alabama	13	7	8	4	-	2	4	5	-	-	2	2	-	1	-	1	-	-	37	2	-	1	1	4	6	5	11	1	12	3	94	38	6.27	2.53	2.47
Alaska	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	1	-	-	-	-	-	-	-	-	-	-	14	1	0.94	0.67	14.00
Arkansas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	1	4	4	-	-	3	1	10	1	8	2	5	4	35	13	2.33	0.87	2.70
California	-	1	7	2	12	1	-	1	-	1	-	-	-	-	12	2	1	1	-	-	-	-	1	1	2	1	34	2	3	1	58	13	3.87	0.87	4.46
Colorado	-	-	-	1	-	-	4	3	1	1	-	-	-	-	-	-	-	-	5	2	1	1	1	1	-	1	8	1	1	2	85	18	5.67	1.20	4.72
Illinois	-	3	10	2	2	1	3	3	54	1	-	-	-	-	2	-	-	-	22	2	-	-	1	-	16	3	-	-	-	1	72	12	4.80	0.80	6.00
Indiana	-	-	-	-	28	1	-	-	4	2	-	-	-	-	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	0.13	0.07	2.00
Kansas	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	1	28	1	-	-	16	2	10	4	121	20	8.07	1.33	6.05
Kentucky	11	3	16	1	-	-	3	1	26	2	-	1	1	1	9	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	0.07	0.07	1.00
Maryland	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	74	1	74	1	4.93	0.07	74.00
Montana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22	4	1.47	0.27	5.50
New Mexico	-	-	-	-	8	3	-	-	14	1	-	-	-	-	4	1	-	-	2	1	-	-	72	1	32	2	-	-	7	3	209	16	13.93	1.07	13.06
Ohio	3	3	1	2	88	3	-	-	-	-	-	-	3	2	-	-	3	1	-	-	1	1	2	1	1	1	5	2	7	3	142	20	9.47	1.33	7.10
Oklahoma	1	1	71	4	45	2	-	-	3	2	-	-	3	2	-	-	-	-	-	-	1	1	2	1	1	1	5	2	7	3	142	20	9.47	1.33	7.10
Pennsylvania	70	9	16	8	23	7	7	6	9	6	16	14	24	11	8	10	14	5	30	7	3	3	-	2	76	5	5	5	1	4	302	102	20.13	6.80	2.96
Tennessee	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	1	1	2	-	2	10	1	12	10	0.80	0.67	1.20
Utah	1	2	30	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	32	6	2.13	0.40	5.33
Virginia	2	1	-	-	-	-	54	3	-	-	2	3	18	2	-	-	2	1	46	3	4	1	1	1	-	-	-	-	-	1	129	16	8.60	1.07	8.07
Washington	-	-	17	2	-	2	-	-	2	1	-	2	-	-	4	1	2	-	-	1	-	2	1	2	-	-	-	1	-	1	21	19	1.40	1.27	1.10
West Virginia	36	7	23	5	11	4	11	7	9	5	8	4	5	4	3	3	36	8	5	3	6	4	95	2	18	4	65	4	22	4	353	68	23.53	4.53	5.19
Wyoming	-	-	-	-	-	-	-	-	-	-	-	-	3	1	-	-	-	-	5	1	-	-	-	-	-	-	-	-	-	-	8	2	0.53	0.13	4.00
Total	139	38	199	34	217	26	87	33	122	22	28	26	54	22	38	25	62	20	170	29	16	14	206	18	163	26	152	22	152	32	1805	387	120.33	25.80	4.66

Generated on 2024-09-19 13:49 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

.0048

Generated on 2024-09-19 13:47 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

Original from
THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 13:48 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

TABLE 4. - Comparison of explosions by ignition causes, fiscal years 1929-43, inclusive

Year	Ignition by electricity		Ignition by open lights or smoking		Ignition by explosives		Ignition due to unknown or miscellaneous causes		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1929	18	47.4	11	29.0	8	21.0	1	2.6	38	100
1930	18	52.9	8	23.5	6	17.6	2	6.0	34	100
1931	9	34.6	11	42.3	6	23.1	-	-	26	100
1932	10	30.3	15	45.5	5	15.1	3	9.1	33	100
1933	8	36.4	8	36.4	4	18.1	2	9.1	22	100
1934	10	38.5	9	34.6	3	11.5	4	15.4	26	100
1935	10	45.4	8	36.4	2	9.1	2	9.1	22	100
1936	5	20.0	17	68.0	1	4.0	2	8.0	25	100
1937	12	60.0	5	25.0	1	5.0	2	10.0	20	100
1938	10	34.5	11	37.9	6	20.7	2	6.9	29	100
1939	9	64.3	3	21.4	-	-	2	14.3	14	100
1940	6	33.3	5	27.8	5	27.8	2	11.1	18	100
1941	14	53.8	9	34.6	3	11.6	-	-	26	100
1942	14	63.6	2	9.1	2	9.1	4	18.2	22	100
1943	19	59.4	9	28.1	3	9.4	1	3.1	32	100
Total	172	44.4	131	33.9	55	14.2	29	7.5	387	100
Average	11.5	44.4	8.73	33.9	3.67	14.2	1.93	7.5	25.8	100

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The number of explosions of electrical origin during the past year (10) is about 72.7 percent more than the average for the preceding 14 years (11); the fact that for the past fiscal year electrical ignitions increased 72.7 percent over the average of the previous 14 years (and the percentage for the previous 14 years was far too great) indicates that the coal mines of the United States have an increasingly serious problem in trying to safeguard their employees against the hazards of electrical ignitions. The number of explosions caused by open lights or smoking (9) about equals the average (8.7) from these causes for the preceding 14 years; this indicates that notwithstanding the expenditure of much effort towards prevention of this type of hazard, essentially no progress has been made.

Table 4 shows that 3 explosions were caused by explosives during the past year, compared with 2 in the previous year and an average of 3.7 for the preceding 14 years; here, again, relatively little progress has been made in the past 15 years, though there is much improvement over conditions of 25 or more years ago.

One explosion is listed under unknown or miscellaneous causes.

EXPLOSION FATALITIES, BY CAUSES

Table 5 compares explosion fatalities by causes and shows that during the past 15 years, 1,805 fatalities resulted from explosions in the United States, an average of 121 a year. The record of explosion fatalities during the fiscal year 1943 was the same as for 1942 (152) and is well above (25.6 percent) the average for the preceding 14-year period (121). The 5 major explosions during the year resulted in 122 deaths, and 27 minor explosions in 30 deaths, compared with the record for the fiscal year 1942 when 7 major explosions and 135 deaths, and 15 minor explosion with 17 deaths occurred. In the fiscal year 1939 there were no major explosion disasters and but 16 fatalities from minor explosions.

Generated on 2024-09-19 13:46 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 13:50 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

TABLE 5. - Comparison of explosion fatalities by causes of ignition, fiscal years 1929-43, inclusive

Year	Ignition by electricity		Ignition by open lights or smoking		Ignition by explosives		Ignition due to unknown or miscellaneous causes		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1929	93	66.9	14	10.1	26	18.7	6	4.3	139	100
1930	154	77.4	21	10.5	24	12.1	-	-	199	100
1931	143	65.9	56	25.8	18	8.3	-	-	217	100
1932	11	12.7	33	37.9	42	48.3	1	1.1	87	100
1933	25	20.5	63	51.6	29	23.8	5	4.1	122	100
1934	21	75.0	2	7.1	2	7.1	3	10.8	28	100
1935	29	53.7	6	11.1	3	5.6	16	29.6	54	100
1936	20	52.6	10	26.4	4	10.5	4	10.5	38	100
1937	53	85.5	3	4.8	-	-	6	9.7	62	100
1938	24	14.1	77	45.3	61	35.9	8	4.7	170	100
1939	13	81.3	2	12.5	-	-	1	6.2	16	100
1940	99	48.3	2	1.0	103	49.7	2	1.0	206	100
1941	145	89.0	15	9.1	3	1.9	-	-	163	100
1942	133	87.5	3	2.0	2	1.3	14	9.2	152	100
1943	66	43.42	86	56.58	3	-	0	-	152	100
Total.	1029	57.01	393	21.77	317	17.57	66	3.65	1805	100
Average	68.60	57.01	26.2	21.77	21.13	17.57	4.4	3.65	120.33	100

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Explosions of electrical origin were responsible for 66 (43.4 percent) deaths during the past fiscal year. This represents a marked decrease over the 133 deaths from this cause during the previous year and is slightly less than the average of 69 deaths for the preceding 14 years. However, it is significant that all of the major (5) and 14 of the minor explosions were caused by electricity. The experience of 1943 bears out the statement made before in these circulars, that "explosions of electrical origin will continue to occur if haphazard methods in the use of electrical equipment are continued." The shortage of trained personnel and difficulty experienced in obtaining necessary equipment and replacement parts added to the greatly increased demand for coal with rapid expansion of mechanized mining during the past year may have been major contributing factors resulting in the increased number of explosions of electrical origin. These conditions necessitate that extra precautions be taken on the part of supervisory officials to see that electrical equipment is properly operated and otherwise safeguarded. One of the main factors in the increase of explosions of electrical origin is that the demand for increased production of coal has brought about a rapid adoption of two or three shift operations, one of the results being that electrically operated machinery must be kept in practically continuous operation with little or no opportunity for the making of repairs unless the equipment actually breaks down and even then the repair work is hurried. In many instances permissible electrical equipment is allowed to become unsafe because a bolt or gasket has not been replaced after the machine has been repaired.

Open lights resulted in 86 deaths, or 56.58 percent of the fatalities due to explosions during the past fiscal year, compared with 3 deaths (1.9 percent) for the previous year and to an average of 22 deaths from this cause during the preceding 14 years; modern operating conditions in coal mining make it imperative that no smoking or open lights be allowed. One explosion, with no deaths, resulted when a miner attempted to clear his flame safety lamp in the presence of gas by placing it near a jet of compressed air. The hazards of smoking, open lights, and careless use of flame safety lamps are now so obvious that it is difficult to understand why any conscientious, well-informed coal-mine operators and employees continue to use or misuse such equipment and practices.

During the past 15 years, 317 deaths (17.57 percent of all deaths due to explosions) resulted from explosives. During the past fiscal year, 3 explosions and no deaths resulted from this cause, compared with 2 deaths during the previous year and an average of 22.6 for the preceding 14 years.

Generated on 2024-09-19 13:48 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

CAUSES OF EXPLOSIONS STARTED BY ELECTRICITY

Table 6 gives data available to the Bureau of Mines on causes of explosions of electrical origin in the United States for the past 15 years. During this period there are known to have been at least 172 explosions of electrical origin, of which 19, with 66 deaths, occurred during the past fiscal year.

Trolley or cable-reel locomotives and nonpermissible mining machines jointly were responsible for 43 percent of the explosions of electrical origin during the 15-year period and for 21 percent occurring durin the past year.

During the past year electric arcs from various sources other than those specifically classified were responsible for 7 explosions, nonpermissible electric drills for 5 explosions, nonpermissible mining machine for 4 explosions, nonpermissible electric motors for 2 explosions, and a blown-out cable was responsible for 1.

Most coal-mine explosions of electrical origin during the past 15 years have shown evidence of carelessness of various kinds, including a flagrant disregard of safe ventilation practices, such as leaving doors open (generally latched open) on main or important haulage entries; not using line brattices where they certainly should be used, or permitting line brattices to be in poor condition or not extended close enough to the face; inadequate ventilation by blower-fan methods (this being manifested in numerous different ways); coursing of air through or past partly caved more or less inaccessible, and hence poorly ventilated workings; or other manifestations of neglect to control the air currents through and past mine workings and especially working faces. Other factors in these electrical ignitions of gas and dust were (1) failure to test for gas before going into working places with electrical equipment, such as mining machines, electric locomotives, loading machines, or electric drills, or failure to test from time to time while using this equipment; (2) use of electrical equipment too soon after the mine fan has been started after a shut-down; (3) failure to examine a mine properly on idle days when only a skeleton crew is in the mine; (4) use of haulageways as return airways, a practice that is always hazardous in the extreme, whether in gassy or nongassy mines; (5) failure to install and utilize permissible electrical equipment or to maintain permissible electrical equipment in a safe or permissible condition; (6) haphazard methods of making cable splices and in attaching cable nips to power wires; and other heedless and careless practices in connection with coal-mine procedures directly or indirectly involving ventilation.

Generated on 2024-09-19 13:46 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 13:44 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

TABLE 6. - Electrical causes of explosions, fiscal years 1929-43, inclusive

Type of equipment	Explosions of electrical origin by fiscal years															Total 15 years	Number killed	
	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943		1942	1943
Trolley or cable-reel locomotive 1/	5	5	1	1	4	5	3	1	5	4	3	-	3	1	-	40	1	-
Nonpermissible mining machine 2/	5	5	3	3	1	-	2	1	3	3	-	2	4	2	4	37	16	20
Nonpermissible electrical motor	4	3	-	-	-	-	2	-	-	1	2	-	1	-	2	15	-	-
Nonpermissible shot-firing battery or circuit	-	3/2	3/3	1	-	1	-	-	-	-	-	-	-	-	-	2	-	-
Cable nips or blown-out cable	-	2	-	-	-	1	-	-	1	-	1	-	1	-	1	7	-	-
Nonpermissible electric drill	-	-	-	2	-	1	2	-	-	-	2	2	3	1	5	18	1	8
Nonpermissible storage-battery locomotive	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-
Nonpermissible electric hoist	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-
Faulty wiring	2	2	-	-	-	-	-	1	1	-	-	-	-	-	-	6	-	-
Trolley wire	1	-	2	1	-	-	-	1	-	-	-	-	1	2	-	8	8	-
Electric arc	2	-	1	2	1	2	1	4/1	1	2	1	2	1	8	7	32	107	38
Signal wire	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	2	-	-
Total	18	18	9	10	8	10	10	5	12	10	9	6	14	14	19	172	133	66

1/ One not included in total; may have been from open light.
2/ One not included in total; may have been from smoking.
3/ Not included in total; may have been from overcharged shot.
4/ Included, but may have been from smoking.

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

COMPARISON OF LIGHTING IN MINES WHERE EXPLOSIONS OCCURRED

Table 7 indicates the method of lighting in mines where explosions occurred during the past 15 years. Of the 387 explosions that occurred during this period, 132 (34.1 percent) were in open-light mines, 232 (59.9 percent) were in closed-light mines, and 23 (6.0 percent) were in mines in which the lighting practice is unknown. During the past fiscal year 11 (34.4 percent) of the explosions occurred in open-light mines, compared with an average of 8.6 explosions per year in open-light mines during the preceding 14 years.

The fact that during the past fiscal year 53.1 percent of the explosi occurred in closed-light mines and that during the past 15 years 59.9 percent of all explosions occurred in mines using closed lights may be interpreted in several in several ways. Probably the most nearly correct explanation is that in many States the most gassy, hence the most dangerous mines now use closed lights. No explosion is known ever to have been caused by an electric cap lamp; this indicates that almost unquestionably there has been carelessness in other explosion-prevention practices, otherwise more than half of the coal-mine explosions in recent years would n have occurred in closed-light mines. In many mines in which closed lights have been adopted, undue dependence is placed on the lamps, with the result that ventilation and other precautionary measures are neglecte Among the bad practices followed in mines or parts of mines known to give off explosive gas and placed on a closed-light basis is the use of op types of electrical equipment (pumps, drills, cutting machines, loading machines, conveyor motors, etc.), a flagrant violation of sane mining practice that is absolutely unnecessary and inexcusable. Moreover, smoking is practiced in many closed-light mines, sometimes with the consent of the management but more frequently through violation of company rules or State laws or regulations. Use of the up-to-date permissible electric cap lamp is unquestionably one of the most effective means now known of promoting safety in mining (coal or metal), and any individual or agency that fails to use or tries to prevent the use of electric cap lamps in mines is woefully ignorant of mine safety requirements or is deliberately callous to the operation of mines on anything approaching an efficient or a humanitarian basis. On the other hand, any neglect of other essential safety procedures through placing undue reliance on electric cap lamps is bound to cause disaster sooner or later.

Generated on 2024-09-19 13:46 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 13:45 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

TABLE 7. - Summary of lighting in mines where explosions occurred, fiscal years 1929-43, inclusive

Year	Open lights		Closed lights		Lighting unknown		Total	
	Explosions	Percent	Explosions	Percent	Explosions	Percent	Explosions	Percent
1929	18	47.4	19	50.0	1	2.6	38	100
1930	8	23.5	25	73.5	1	3.0	34	100
1931	12	46.2	14	53.8	-	-	26	100
1932	15	45.5	14	42.4	4	12.1	33	100
1933	7	31.8	14	63.6	1	4.6	22	100
1934	9	34.6	14	53.9	3	11.5	26	100
1935	5	26.1	17	73.9	-	-	22	100
1936	15	60.0	9	36.0	1	4.0	25	100
1937	4	20.0	12	60.0	4	20.0	20	100
1938	10	34.5	16	55.2	3	10.3	29	100
1939	2	14.3	12	85.7	-	-	14	100
1940	6	33.3	11	61.1	1	5.6	18	100
1941	5	19.2	21	80.8	-	-	26	100
1942	5	22.7	17	77.3	-	-	22	100
1943	11	34.4	17	53.1	4	12.5	32	100
Total	132	34.1	232	59.9	23	6.0	387	100

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

EXPLOSION FATALITY RATE, BY STATES

Table 8 gives the explosion-fatality rate per million tons of coal produced, by States, from 1929 to 1942, inclusive; this tabulation is by calendar (not fiscal) years. During this 14-year period, Pennsylvania produced 2,265,615,745 tons of coal with an explosion-fatality rate of 0.149; West Virginia produced 1,597,931,281 tons of coal with a rate of 0.199; Illinois produced 678,806,021 tons with a rate of 0.116; and Kentucky produced 640,052,673 tons with a rate of 0.198, all being below the National rate of 0.325. It is significant to note that the rate for the larger coal-producing States is much lower than that for the smaller producing States. Alaska has the highest rate listed; however, only one explosion occurred, causing 14 fatalities, the total tonnage being low. In the United States, Oklahoma has the highest rate, 5.932, or about 18 times the rate of the United States as a whole (0.325). Other States with high rates being Arkansas (2.781), New Mexico (1.089), Washington (0.832), Virginia (0.69[illegible] Ohio (0.631), and Colorado (0.543).

Tennessee has the lowest fatality rate of the States listed in the tabulation. Maryland and Kansas, having had only one explosion each during this period, have the next lowest rate, except Montana, which had no loss of life through explosions in the 14 years 1929-42, inclusive, though an explosion occurred in Montana early in 1943, causing 74 fatalities.

Generated on 2024-09-19 13:51 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

TABLE 8. - Explosion-fatality rate per million tons, by States, calendar years 1929-42, inclusive

	Fatality Rate per million tons of coal produced														Total, 14 years
	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942 1/	
Alabama	-	0.514	0.417	-	0.114	0.219	-	-	2.582	0.268	0.083	0.065	1.071	-	0.470
Alaska	-	-	-	-	-	-	-	-	10.613	-	-	-	-	-	6.943
Arkansas	-	1.956	1.733	-	-	1.167	1.796	4.934	4.493	-	3.524	6.976	1.215	3.864	2.781
Colorado	-	-	.151	0.179	-	-	-	1.171	-	-	.116	.300	-	4.511	.543
Illinois	0.115	.074	.045	1.643	.053	-	-	-	.057	.094	-	.020	.163	-	.116
Indiana	-	-	1.959	.075	.218	-	-	.119	1.271	-	-	.053	.713	-	.306
Kansas	-	.823	-	-	-	-	-	-	-	-	-	-	-	-	.050
Kentucky	.182	.311	.075	.651	.083	.104	.221	.212	.064	-	.681	-	.300	.167	.198
Maryland	-	-	-	.700	-	-	-	-	-	-	-	-	-	-	.041
Montana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New Mexico	-	4.066	-	11.081	-	-	-	-	-	-	-	-	-	-	1.089
Ohio	-	3.503	.245	-	-	-	.236	-	.079	-	-	4.512	.034	.116	.631
Oklahoma	16.163	16.464	.524	.797	2.423	1.655	1.627	2.613	.636	1.632	8.319	2.458	2.277	1.905	5.932
Pennsylvania 2/	.009	.170	.127	.056	.147	.116	.174	.098	.055	.249	.035	.374	.103	.025	.149
Tennessee	-	-	-	-	-	-	-	-	-	-	-	.334	-	-	.028
Utah	-	6.342	-	-	-	-	-	-	-	-	-	-	.243	-	.558
Virginia	-	-	-	7.020	.245	1.919	-	-	.070	3.929	-	.064	-	-	.697
Washington	-	7.385	-	1.259	-	-	-	-	.492	-	-	.601	-	-	.832
West Virginia	.014	.173	.207	.082	.064	.051	.060	.162	.169	.108	.056	.807	.086	.523	.199
Wyoming	-	-	-	-	-	.687	-	-	-	.958	-	-	-	-	.102
Total United States	0.118	0.492	0.164	0.470	0.104	0.125	0.115	0.116	0.124	0.430	0.103	0.579	0.170	0.233	0.325

1/ Tentative figures.
2/ Includes both bituminous and anthracite mining.

Generated on 2024-09-19 13:42 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

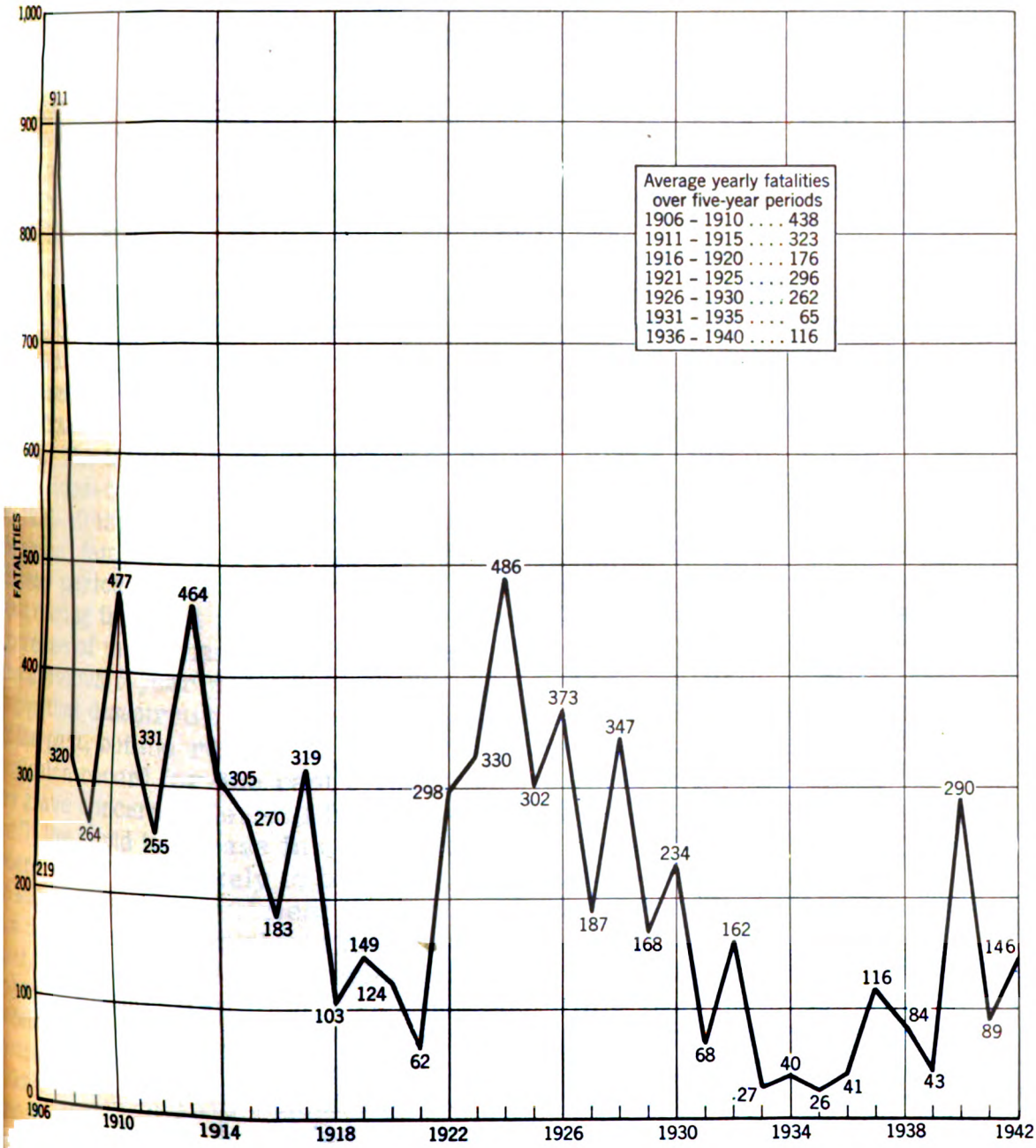

Figure 1.- Fatalities from gas and coal-dust explosions in bituminous-coal mines.

Generated on 2024-09-19 13:48 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

I.C. 7274

EXPLOSIONS IN BITUMINOUS-COAL MINES

Figure 1 shows the trend of fatalities resulting from gas and dust explosions in bituminous-coal mines of the United States during the calendar years 1903 to 1942, inclusive. The trend of explosion fatalities was downward from 1907 to 1921, with a marked rise from 1922 to 1924 and a definite, relatively steady decline from 1924 to 1935; however, the trend has been upward during the past 6 years, especially in 1937, 1938, 1940, 1941, and 1942. It is significant that in every alternate year from 1934 to 1936 the number of deaths has increased over that of the preceding year, although the general trend has been downward. A plausible explanation is that a year with a relatively low explosion-fatality record causes relaxation in efforts to prevent accidents (or at least in prevention of explosions) during the following year; conversely, a year with a high explosion-fatality record causes additional precautionary measures to be taken. The tabulation on the graph of average annual fatalities from bituminous-coal-mine explosions for 5-year periods from 1906-10 to 1936-40 is illuminating, as it shows a larger and fairly steady decrease in annual fatalities from 438 for the 5-year period 1906-1910 to 65 for the 5-year period 1931-35, a drop of 85.5 percent; however, it is also shown that during the most recent 5-year period, 1936-40, there has been an increase of more than 78 percent in explosion fatalities, as compared with the previous 5-year period, 1931-35. The record for 1931-35 bolstered hopes that disastrous mine explosions in the United States were a thing of the past, but the record of the past 3 years has shattered them. The explosion record for the past 3 years should cause the coal-mining industry grave concern. Several factors contribute to this bad record, such as (1) the rapid increase in use of electrical equipment at face regions, where gas is most likely to be found; (2) the increased demand for coal to supply defense industries; (3) desire of mining-machine manufacturers and mine operators to obtain maximum tonnage per machine at minimum cost, which has resulted in neglect of rudimentary precautionary measures; (4) multiple-shift operation, which does not allow time for adequate maintenance of equipment, proper rock dusting, and testing for gas by fire-bosses; (5) decrease in supervision owing to demands on supervisors for maximum tonnage; (6) lack of effective supervision owing to numerous duties; (7) inability to obtain adequate equipment repair and replacement parts; (8) shortage of skilled labor; and (9) failure of both miners and mining officials to show regard for safety in changing from hand-loading to mechanized methods.

In view of the past year's experience, and considering the fact that the demand for coal probably will increase greatly during the coming year, the outlook is not at all bright if the same unsafe methods and procedures are pursued.

Generated on 2024-09-19 13:49 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

MINE FIRES

Because of the highly combustible nature of coal, timber, explosives, and other materials usually present in coal mines, the potential hazard of fire is always present in every coal mine, even when the mine is classed as damp or wet and whether it is gassy or so-called nongassy. Some coals, oil, and other materials found or used in mines ignite spontaneously under certain conditions and create a serious hazard; however, the igniting agencies that cause most mine fires are electricity, explosives, and open lights. Despite ever-present fire hazards, the mines of the United States have been fortunate during the past decade in that they have not experienced a fire that caused very large loss of life; however, a number of fires have involved considerable property damage. Although much can be done to prevent mine fires, some companies still employ methods or equipment that have caused and probably will continue to cause fires in their mines; these include the use of black powder and fuse; shipshod methods of installing, using, and maintaining electrical equipment; use of open lights; smoking; and employment of numerous other loose, unsafe, and out-of-date mining equipment, methods, and practices.

During the past fiscal year 21 coal-mine fires, which resulted in the death of 15 men, were called to the attention of the Bureau of Mines. Fires of others were detected and extinguished promptly without much damage or were handled quietly and not reported to the Bureau of Mines, the general public, or even State inspection forces. Six fires were reported as having occurred in non-coal mines.

Table 9 shows that during the past fiscal year five fires were reported in West Virginia, four in Colorado, three in Ohio, two in Tennessee, one each in Alaska, Arkansas, Illinois, Kentucky, North Dakota, Pennsylvania, and Utah. The 21 coal-mine fires reported during the fiscal year 1943 were 4 more than in the preceding year and the average for the preceding 13 years. The 15 fatalities from fires aggregated 6 more than in the preceding year but 8 more than the average (7) for the preceding 13 years.

1943

Generated on 2024-09-19 13:49 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 13:48 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

TABLE 9. - Summary of mine fires, by States, fiscal years 1943 and 1930-42, inclusive

State	Lighting used			Fatalities, by cause of ignition								Total	
				Electricity		Open lights		Explosives		Unknown or miscellaneous			
	Open	Closed	Unknown	Deaths	Fires	Deaths	Fires	Deaths	Fires	Deaths	Fires	Deaths	Fires
Alaska	-	1	-	-	-	-	-	-	-	2	1	2	1
Arkansas	1	-	-	-	-	-	-	-	-	-	1	-	1
Colorado	2	1	3	-	-	-	-	-	-	-	6	-	6
Illinois	-	-	2	-	-	-	-	-	-	-	2	-	2
Kentucky	-	-	1	-	-	-	-	-	-	-	1	-	1
Michigan	1	-	1	-	-	-	-	-	-	-	2	-	2
Minnesota	1	-	-	-	-	-	-	-	-	-	1	-	1
Montana	1	-	-	-	-	-	-	-	-	-	1	-	1
North Dakota	1	-	-	-	-	-	-	-	-	-	1	-	1
Ohio	1	-	2	-	1	-	-	-	-	-	2	-	3
Pennsylvania	-	-	1	-	-	-	-	-	-	-	1	-	1
Tennessee	-	-	1	-	1	-	-	-	-	-	-	-	1
Utah	-	1	-	-	-	-	-	-	1	-	-	-	1
West Virginia	-	4	1	13	4	-	-	-	-	-	1	13	5
Total 1943	8	7	12	13	6	-	-	-	1	2	20	15	27 1/
1942	10	7	9	4	9	-	2	-	1	17	14	21	26
1941	3	8	5	2	7	-	-	-	3	-	6	2	16
1940	12	9	6	2	5	-	2	-	1	-	19	2	27
1939	9	9	2	1	8	-	1	-	3	2	8	3	20
1938	7	6	11	1	7	2	2	-	1	5	14	8	24
1937	7	4	10	9	5	-	-	-	3	2	13	11	21
1936	16	4	3	1	7	-	2	-	3	3	11	4	23
1935	7	5	14	11	11	-	1	-	-	-	14	11	26
1934	10	5	3	-	4	-	-	5	5	1	9	6	18
1933	12	6	9	-	7	-	-	-	2	2	18	2	27
1932	8	5	8	1	8	-	-	-	3	-	10	1	21
1931	12	7	5	-	7	5	3	-	5	18	9	23	24
1930	7	8	9	2	9	3	6	-	3	-	6	5	24
Total, 14 years	128	90	106	47	100	10	19	5	34	52	171	114	3242

1/ Excludes 55 metal-mine fires and 11 outcrop fires.

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

SUMMARY

1. It is interesting to note that of the 28 major coal-mine-fire disasters, with a total of 594 fatalities since 1900, only 7 (with 57 deaths) occurred since 1921, and that no major coal-mine fires occurred in the United States from 1926 to 1933, inclusive. Three major fires have occurred during the past 2 years; during the fiscal year 1943, a fire in a West Virginia mine resulted in 13 deaths, and in 1942, 10 were killed in a fire in Colorado and 5 in a fire in Pennsylvania. If the necessary precautions are not taken, coal-mine fires may be a great potential hazard and may jeopardize the lives of many men, not only those who are cut off from escape but also those engaged in fighting the fire. The action of mine officials during several fires of the past few years clearly indicates lack of knowledge as to procedure in controlling such fires and an apparent indifference to the hazards resulting from them. Every mine should be provided with ample fire-fighting material placed at strategic places in the mine, and officials should be instructed in the proper procedure to follow in case of fire.

2. The decrease in frequency and severity of explosions in the United States during the past 30 years has been encouraging. The record of the fiscal year 1939 was the best in the history of coal mining since it became a major industry; however, the increase in frequency and severity of explosions during the past 4 years has caused great concern to those agencies seeking to prevent such disasters. Most coal-mine explosions result from human failure by men or management to take the precautions that they know, or at least should know, are necessary to prevent such occurrences; and failure to know those precautions unquestionably is their own fault, as the desirable precautions have been given much publicity for the past two decades.

The past 3 years have shown a noteworthy increase in number of explosions caused by electricity, open lights, and smoking, which might indicate that in its demand for greater production, managements, and to a less extent the workers, have neglected to take proper precautions in the use of electrical equipment. In the practice of smoking underground, both workers and officials are definitely responsible; the management, because it has not exercised the right kind or amount of discipline, and the workers, because they have allowed fellow workers who persist in smoking to perform what is essentially a criminal act in any coal mine, inasmuch as conditions are almost certain to be so hazardous that smoking should be prohibited if the lives of the workers and the property of the management are to be adequately safeguarded.

Generated on 2024-09-19 13:45 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Some of the salient points brought out by the Bureau of Mines in its study of explosions and fires in the United States during the fiscal year ended June 30, 1943, are:

1. Thirty-two explosions, all but two in bituminous-coal mines, were studied, as against 22 explosions in 1942 and an average of 25.3 explosions a year during the previous 14 years. This is an increase of about 45 percent over the previous year and about 27 percent over the average for the preceding 14 years.

2. Coal-mine explosions resulted in the loss of 152 lives during the fiscal year 1943, compared with a loss of the same number the previous year and an average of 118 lives in the previous 14 years. The anthracite mines of Pennsylvania, which employ about 100,000 men and produce 50 to 60 million tons of coal (much of it from mines that are decidedly gassy and difficult to ventilate), had only two explosions, with no deaths, last year, and have operated for more than 5 years without a major explosion disaster.

3. The five major explosions during the past fiscal year caused 122 deaths, compared with seven major explosions with 135 deaths in 1942. Of the five major explosions in 1943, all but one occurred in mines that were wholly or partly mechanized. One of the mines in which major explosions occurred was reported to have been rock-dusted, (12 fatalities two were reported to have been only partly rock-dusted, (26 fatalities), and two had no rock dust, (84 fatalities). Had proper rock-dusting to prevent propagation of explosions been in effect at all of these mines, the death toll undoubtedly would have been reduced greatly, and possibly one or more of the explosions could have been prevented. Failure to rock-dust a mine adequately is absolutely inexcusable, as rock-dusting is relatively inexpensive and, if kept up to standard, is almost certain to prevent spreading of explosions. It is significant to note that in the 28 bituminous mines in which explosions occurred during the year, eight (with five fatalities) occurred in rock-dusted mines, and 15 (with 104 fatalities) occurred in mines with no rock dust. Including both major and minor explosions occurring during the year, 9 occurred in rock-dust mines, with an average of 1.44 deaths per explosion; 7 occurred in partly rock-dusted mines, with an average of 1.43 deaths per explosion, whereas 17 occurred in non-rock-dusted mines, with an average of 6.12 deaths per explosion. No deaths resulted from 5 of the explosions in rock-dusted mines, from 2 of the explosions in partly rock-dusted mines, and from 8 the explosions in non-rock-dusted mines.

4. Eleven explosions occurred in open-light mines, compared with 5 in 1942 and an average of 8.3 in the preceding 14 years; 17 were

Generated on 2024-09-19 13:50 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

in closed-light mines, compared with a like number in 1942 and an average of 18.2 in the preceding 14 years. In the fiscal year 1943, as in former years, some of the explosions in closed-light mines were caused by open flames, such as matches and carbide lamps, and the misuse of flame safety lamps. No explosions were reported to have been caused by smoking during the year. Almost every year at least one explosion is caused by shot firers or officials attempting to relight their flame safety lamps with matches. Although no explosions resulted from this cause during the past year, one explosion, with one death, resulted when a flame safety lamp in the presence of gas, was held in front of a jet of compressed air. One explosion in a closed-light mine was caused by a match used to light a fuse. Mine explosions during the past year, resulting in 89 deaths, were caused by gas ignitions by carbide lamps. This is an explosion cause in which both workers and management are at fault, as both know, or should know, that the use of open lights in any mine, especially coal mines, is hazardous.

5. Nineteen explosions, causing 66 deaths, were of electrical origin, compared with 14 such explosions and 133 deaths in the previous year and an average of 11 explosions and 69 deaths for the preceding 14 years. As previously pointed out, the greatly increased use of electricity, with the necessarily greater amount of wiring, trailing cables, and other accessories, has multiplied the hazard of electrical ignitions, largely because most of this equipment is operated at or near face regions, where much gas and dust are given off. Under present conditions of labor shortage resulting in improper maintenance of equipment and difficulty in obtaining replacement of cables and repair parts, the electrical ignition hazard is more serious than it would be under normal conditions. In view of this, it is necessary for both the worker and the supervisor to exercise greater precautions and to see that gas and dust are not permitted to accumulate.

6. Three explosions, with no deaths, were caused by explosives during the fiscal year 1943, compared with two such explosions and two deaths in 1942 and an average of 3.7 explosions and 22.6 deaths annually in the preceding 14 years. The use of dynamite or black blasting powder, either in granular or pellet form, in coal mines is a definite violation of established safe mining practice and will continue to take lives until its use is prohibited by law or is abandoned voluntarily. Carelessness in the practice of using permissible explosives also is almost certain to result in disaster; in fact, carelessness in storage and use of explosives is now and always has been flagrant in and around coal mines; and here, again, the responsibility rests jointly with workers and management.

7. Of the explosions that occurred during the past fiscal year, 29 are thought to have been initiated by ignition of gas and three by ignition

Generated on 2024-09-19 13:43 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

of coal dust. In alsmot all of the explosions initiated by ignition by gas, it was indicated that the ventilating current had been interrupted or was inadequate, or it was not directed properly; in one or more instances it was indicated that inspections had been inadequate, and that the hazard of gas had been ignored.

Five of the explosions occurred in so-called nongassy mines; as has been the case scores of times in the past, the occurrence of these five explosions in so-called nongassy or slightly gassy mines indicates that all coal mines are potentially gassy or may become so unexpectedly. The mining laws of some States are inadequate with respect to classification of mines as gassy or nongassy, and as a result many mines are operated on a nongassy basis when it is known that they are in fact gassy, in that explosive gas is known to be given off in them. In several instances the miners have resisted the introduction of permissible electric lamps and oppose or violate rules to prohibit smoking in the belief that the introduction of such equipment and compliance with a nonsmoking rule would cause the operator to relax maintenance of adequate ventilation. Elimination of all possible sources of flame is necessary to prevent ignition of gas, and resistance on the part of miners to eliminate any source of flame does not appear to be well-founded; the logical procedure would seem to be to insist upon adequate ventilation and simultaneously take suitable measures to eliminate all sources of ignition.

Three dust explosions during the year were caused by blown-out shots. Many explosions have resulted from blown-out shots in the past, which were the result of poor practice or to the use of nonpermissible explosives.

The rapid extraction of coal by multiple-shift mechanical mining undoubtedly is responsible for greater liberation of gases, as well as contributing to the release of greatly increased quantities of dust. This condition demands better ventilation, more frequent inspections, and more attention to the ventilation system in general. The speed with which mechanical operations are prosecuted, and the tendency of crews and foremen on one shift to leave necessary repairs for the following shift, or to postpone repairs or replacements until forced to take action, are not conducive to good maintenance and certainly are highly detrimental to safety. One of the common hazards of multiple-shift mechanical mining is the hapha manner in which cable splices are made and maintained in many mines; this slipshod procedure induces numerous hazards, such as contact electrocution, the release of stray currents likely to precipitate premature blasting or misfires, as well as the possibility of causing arcs or sparks likely to ignite gas or dust.

Generated on 2024-09-19 13:44 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

8. The frequency of explosions during the past year (32) showed a marked increase as compared with the previous year (22), though the severity of the explosions was somewhat less. The average number of deaths per explosion last year was 4.7, compared with 6.9 in 1942 and 4.4 during the preceding 14 years. Any increase in severity of explosions at any time is a decidedly unsatisfactory trend and indicates that adequate precautions are not being taken to prevent the spread of explosions, one of the simplest, most effective, and least expensive of which is rock-dusting.

9. The 32 explosions and 152 deaths during the past fiscal year occurred in 13 States, and 13 other coal-producing States had no known explosions.

10. The facts brought out by a study of the explosions that occurred during the past year stress the importance of allaying coal dust at its source. Mechanical mining of coal naturally produces much more fine coal dust than hand-loading methods, hence the need for allaying the dust at its source is greater. Fine coal dust is both an explosion and a health hazard, and every feasible precaution should be taken to suppress it at its source.

11. The undesirability of using main haulageways as return airways was again demonstrated after at least one explosion during the year. In this instance, 6 men were asphyxiated when they attempted to escape through the main haulageway, which was the return airway, and rescue and recovery work was delayed and made unduly burdensome because of this.

12. Rock dust was used in 11 of the 32 mines in which explosions occurred during the past year, but in only a few of these so-called rock-dusted mines had a sincere effort been made to do a good job. The increase in the number of major explosions during the past several years is mute evidence of the inadequacy of rock-dusting practice in the coal mines of the United States.

13. During the fiscal year 1943, 27 fires, with 15 deaths, were reported, compared with 26 fires and 21 deaths in 1942 and an average of 26.6 fires and 7.6 deaths annually for the preceding 13 years.

14. Of the 27 fires that occurred during the year, 6 were of electric origin, 1 was caused by explosives, and 20 were of unknown or miscellaneous origin; 21 were in coal mines and 6 were in metal mines.

Generated on 2024-09-19 13:44 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

15. Although the frequency of mine fires has remained almost constant during the past few years, the severity of such fires has increased considerably. This fact should serve as a warning that in addition to causing loss of life, fires usually cause heavy property damage and almost invariably require considerable ultrahazardous effort in extinguishment or control. The potential hazard of fire in any mine is always serious, especially in coal mines, because a fire can precipitate an explosion. The definite fire hazard that exists in virtually all mines should be recognized, and plans should be placed in effect to handle them quickly and safely if or when they occur.

CONCLUSIONS

This circular was compiled in essentially the same manner as were those of previous years (see Information Circular 6178, 6419, 6540, 6680, 6761, 6819, 6870, 6927, 6986, 7048, 7092, 7136, and 7208) and embodies only facts revealed by studies of field employees of the Health and Safety Service of the Bureau of Mines. The Bureau of Mines attempts to obtain information concerning every explosion and most of the fires in mines of the United States, although some of the less destructive fires may not have been brought to its attention early enough to permit investigation. However, the Bureau rarely fails to obtain fairly complete details of mine explosions in which more than one life has been lost or in which considerable property has been damaged; therefore, the data in these publications are relatively complete.

In some instances, the available information on mine fires is not as complete as that on explosions, as scores of fires undoubtedly occur every year in coal and metal mines, unknown to the Bureau of Mines or even the State inspection force. Mine fires occur almost daily in some coal mines, particularly at shot-firing time, where black blasting powder or dynamite is used or where the coal fires spontaneously; moreover, fires of electrical origin and those caused by open lights are by no means uncommon in metal mines.

A study of available data on mine explosions in the United States during the past 15 years reveals an encouraging reduction in the frequency and severity of such disasters until 1940; however, the record has not been so encouraging during the past 4 years. Explosions in mines in the United States have resulted in an average of 120 fatalities annually during the past 15 years, compared with 152 fatalities in 1943 and 1942, 163 in 1941, and 206 in 1940.

The undue prevalence of major explosions during the past 4 years indicates a lack of proper precautions on the part of coal-mining people

Generated on 2024-09-19 13:47 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

to prevent explosions. Four of the five major explosions in 1943 occurred in mechanized mines. In four of the explosions, in which 122 were killed, electricity is believed to have been the initiating cause, and in the other, in which 74 were killed, an open carbide light is believed to have been responsible. In most of the mines in which major explosions occurred, numerous unsafe practices were followed; some evidently were the result of a lack of respect for the hazard of gas, and others were due to neglect of necessary safety measures, such as the elimination of sources of ignition of gas or dust.

The more rapid extraction of coal with mechanical methods calls for much greater ventilating efficiency, and unless ventilation is maintained so that enough fresh air reaches all working faces to dilute the gases, explosions are certain to continue to occur. In nearly every instance of explosions initiated by ignitions of gas, some deficiency in ventilation has come to light. Consequently, ventilation must be made more effective, and greater vigilance must be maintained in the detection of gas and in eliminating or neutralizing dust, as well as in the elimination of ignition agencies. Many explosions result directly or indirectly from carelessness or infraction of rules by employees; therefore, the prevention of explosions is the responsibility not only of management, but of the workers as well. Irrespective of responsibility, the seriousness of the situation brought about by the very bad coal-mine explosion record of the past 4 years cannot be questioned. The demand for greater production and the existence of adverse working conditions owing to the war, necessitate greater vigilance by the workers, the management, and other agencies interested in mine safety if the number and severity of coal-mine disasters is to be reduced to a reasonably low minimum.

Generated on 2024-09-19 13:44 GMT / https://hdl.handle.net/2027/osu.32435030643894
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY